Name _____

Genetics Problems Review

1. Sickle cell disease is an **<u>autosomal recessive</u>** disorder.
   - People with 2 of the recessive alleles have sickle cell disease.
   - If they have 1 recessive allele, they are considered a carrier, which has actually proven beneficial against malaria. This is known as sickle cell trait.

Using S for the normal allele and s for the sickle cell allele, cross the following couple:

- A man who has sickle cell disease
- A woman who is normal but whose father had sickle cell disease.
  (Hint: She must be a carrier)

♂ _____ x ♀ _____

What is the probability they could have a child with sickle cell disease? _____

What is the probability they could have a child with the sickle cell trait (carrier)? _____

2. Albinism is an **<u>autosomal recessive</u>** condition (a) that affects males and females and can skip generations due to carriers. Homozygous recessive individuals lack an enzyme needed to produce melanin, which colors the eyes, skin, and hair.

- A normally pigmented man marries an albino woman.
- Half of their children are normally pigmented and half are albino.

Is the father homozygous or heterozygous? _____

Record the genotypes of the parents and show a Punnett square to prove your answer.

Male Genotype _____ X Female Genotype _____

3. Perform the following **2 factor cross**, supposing that
   - Black hair (B) is dominant over blonde hair (b)
   - Brown eyes (E) are dominant over blue eyes(e)

Cross a male who is heterozygous for black hair AND heterozygous for brown eyes with a female who is homozygous for black hair AND has blue eyes.

♂ _____ x ♀ _____

What is the probability they could have a child with black hair and brown eyes ? _____

What is the probability they could have a child with black hair and blue eyes ? _____

What is the probability they could have a child with blonde hair and blue eyes? _____

4. Perform the following **2 factor cross**, supposing that
   - Dimples (D) are dominant over no dimples (d)
   - Freckles (F) are dominant over no freckles (f)

Cross a male who is heterozygous for dimples AND does not have freckles with a female who is homozygous for dimples AND is heterozygous for freckles.

♂ _____ x ♀ _____

What is the probability they could have a child with dimples AND freckles? _____

What is the probability they could have a child with dimples and NO freckles ? _____

What is the probability they could have a child with NO dimples AND NO freckles? _____

5. Draw a pedigree to trace the inheritance of albinism, an **autosomal recessive** condition, in the following family:

- One normally pigmented couple has a son and a daughter with normal skin pigmentation.
- Another normally pigmented couple has one albino son and two daughters with normal skin pigmentation.
- The daughter from the first couple has three children with the son of the second couple: Their son and one daughter have albinism; their other daughter has normal skin pigmentation.

6. Tay Sachs disease is a condition in humans that displays **incomplete dominance**.

- A normal individual has the genotype TT.
- Someone with Tay Sachs has the genotype tt. They lack the enzyme Hexosaminidase-A, resulting in brain damage, retardation, and typically death by the age of 5.
- The heterozygous genotype, Tt, results in the production of half as much of the enzyme, which is sufficient for normal development.

Cross a normal male with a heterozygous female. Complete the following.

♂ _____ x ♀ _____

What is the probability they could have a child with Tay Sachs disease? _____

What is the probability they could have a Normal child? _____

What is the probability they could have a child that produces half the amount of the enzyme? _____

7. Human blood types are an example of **multiple alleles** that also display **codominance**. Cross a male with type O blood with a female with type AB blood. Complete the following.

♂ _____ x ♀ _____

What is the probability they would have a child with the following blood types:

A _____ B _____

AB _____ O _____

8. Two babies were born in a hospital at the same time. Their ID bracelets got mixed up.

- Child #1 has blood type A
- Child #2 has blood type O
- Parents "Y" have blood types A x O
- Parents "Z" have blood types A x AB

Which baby belonged to which set of parents? Draw 2 Punnett squares to support your answer.

Parents "Y" A x O
Child # _____ Blood Type ____

Parents "Z" A x AB
Child # _____ Blood Type ____

9. Hemophilia is an **<u>X-linked recessive</u>** trait.
Use H for normal blood clotting and h for hemophilia.
Cross a male who has hemophilia with a female who is a carrier for hemophilia.
Complete the following.

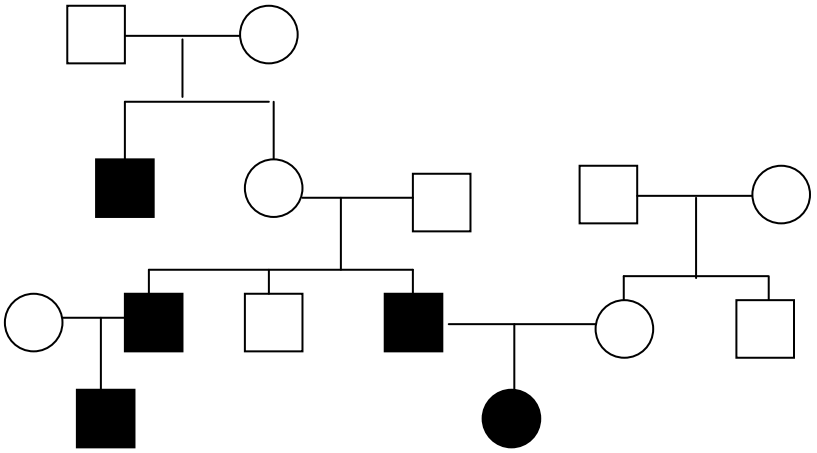
♂ _____ x ♀ _____

What is the probability they could have a **child** who is a male with hemophilia? _____

What is the probability they could have a **child** who is a female with hemophilia? _____

What is the chance they could have a **child** WITHOUT hemophilia? _____

10. Below is a pedigree tracing the inheritance of colorblindness, a **<u>recessive sex-linked</u>** trait.
Using N or normal and n for colorblind, give the correct genotype for the individuals listed.



A _____ B _____ C _____

D _____ E _____ F _____

G _____ H _____ I _____

J _____ K _____ L _____

M _____ N _____ O _____